REMARKS

This is in response to an Office action dated 6/13/2004.

The Examination is based on:
the description, pages 1-26, as originally filed
claims 1-19, as originally filed
drawing pages 1/6 - 6/6, as originally filed

Claims 1-19 are pending in the application.
Claims 1-19 are rejected.

The references relied upon for rejecting the claims are:
US 3,632,701 Devitt et al
US 5,365,781 Rhyne
US 3,120,571 Wolfer .... also cited in US 6,660,212
DE 1 729 614 Offenlegungsschrift
US 6,660,212 Balter, et al. (double patenting)

Grounds of Rejection

1. **Claims 1-19** are rejected under 35 U.S.C. 103(a) as being unpatentable over Devitt et al (see col. 3, line 64 through col. 4, line 28) in view of any of Rhyne (see 280 in Fig. 8 and col. 13, lines 32-36), Wolfer (see 10 in the Figures) or German Offenleg 1,729,614 (see Abstract).

The primary reference discloses the basic claimed method and apparatus for post cure correction of tires which have been selected for treatment due to a tire deformity defect comprising the steps and means to sealingly hold the beads concentric to the axis of rotation of the tire (ie, the embodiment in which the tire is mounted on a rim and inflated) and inflating the tire to a controlled pressure for a controlled period of time to reduce the degree of deformity. The tire is also heated to a temperature within the instant temperature range during the correction treatment. Essentially, Devitt et al lacks a showing of providing a 360-degree circumferential tread restraint during the inflation and heating.

Each of the secondary references discloses restraining the tread of a tire in such a manner during a post cure inflation which follows vulcanization, the post cure inflation designed to reduce defects generated during the vulcanization so that a more uniform tire is produced. Clearly, it is well known in the tire making art to restrain the tread/outer surface of the tire in a

circumferential manner during post cure inflation, which is a process for post cure correction of tires. In that sense, the secondary references constitute analogous art and in fact solve the instant problem of the tread of the tire being unrestrained during a post-cure inflation designed to remove defects (ie, non-uniformities) in the cured tire.

It would have been obvious to one of ordinary skill in this art to employ a tread ring or external tire restraint as taught in the secondary references in the process and apparatus of Devitt et al so that the tread would be conformed to the ideal and desired shape and not be overstretched during the correction.

Devitt et al heats tires with the instant ply cords to a temperature within the instant range so it is submitted that the primary reference is also teaching heating the tire to a temperature above the glass transition temperature of the ply cords as set forth in instant **claim 3**.

It is submitted that repeating the treatment for tires still judged to be unacceptable after a first treatment would have been an obvious modification to the process of Devitt et al particularly since the manufacturer would clearly have nothing to lose by doing so. This is fairly well known in the tire art and if the tire did not improve upon additional treatment, it would be either ground to an acceptable level or discarded.

2. Claims 1-19 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-19 of U.S. Patent No. 6,660,212.

Although the conflicting claims are not identical, they are not patentably distinct from each other because the claims of previously issued patent —212 and the instant claims essentially set forth a method of post cure correcting defects in a tire by heating and inflating the tire while the tread is 360 degree restrained circumferentially. US Patent —212 recites that such correction occurs during a post cure inflation while the instant claims are directed to such a correction after the post cure inflation when the defect has been determined. However, given the similarities between the steps of the two methods and that both are performed after vulcanization of a tire to remove defects resultant from the vulcanization of said tire, it is submitted that the instant method and that set forth in USP —212 are obvious variants over each other.

Traversing the Rejections

The present invention is generally directed to method and apparatus for post-cure correction (PCC), either partial or substantial, of various tire nonuniformities which have been detected during a tire manufacturing process by a tire uniformity machine (TUM), preferably testing a tire which has been nominally cooled down (i.e., nominally completed curing) after removal from a tire curing mold. The method comprises the steps of:

(1) selecting the tire during a tire manufacturing process after the selected tire has been rejected by a tire uniformity test due to at least one tire uniformity defect;

(2) providing 360 degree circumferential tread restraint which holds the tread in an ideal tread shape, concentric to the axis of rotation and nominally perpendicular to the equatorial plane;

(3) sealingly holding the beads concentric to, and equidistant from, the axis of rotation, and symmetrically spaced about the equatorial plane; and

(4) inflating the selected tire to a controlled pressure, and holding the controlled pressure for a controlled time while the tread is restrained and the beads are sealingly held.

An optional additional step before the inflating step (4) comprises heating the selected tire, preferably to a controlled temperature above a glass transition temperature of the tire's ply cord material; and before the end of the controlled time cooling the selected tire below the glass transition temperature. The method steps can be repeated if the corrected tire is still rejectable as determined by a repeated TUM test. An apparatus (PCC device) is provided suitable for implementing the inventive method. (See Abstract)

Devitt (3,632,701) (see col. 3, line 64 through col. 4, line 28) discloses conditioning of tires to improve uniformity. The dynamic radial force variations generated in a cured pneumatic passenger or truck tire are often sufficiently great that they adversely affect the riding characteristics of the tire. In a large percentage of tires, the excessive radial force variations can be reduced by heating all or part of a tire while supported vertically and positioned so that the area of maximum force is located in the top quadrant of the tire. The tire is preferably heated to a temperature of between 150° to 280° F. for a period of time that is sufficient to reduce the force but not otherwise degrade the tire. Typically a time of 60 minutes or less at an inflation pressure of 0 to 50 psi. is adequate. A suitable source such as a pot heater, rubber kiln, or infrared heat may be used for heating. The invention is applicable to nearly all types of tires including radial, belted bias and bias tires containing rayon,

nylon or polyester cords.

In Devitt, after the completely vulcanized tire has been cooled to a temperature below 210° F., it is mounted on a tire uniformity machine. A position of maximum force is determined and this location is marked on the tire. The tire is then placed on a rim, hook or pin rack with the marked point on the tire at the top of the tire and is then heated in a vertical position for a period of time sufficient to reduce the magnitude of the force variations. The tire may be inflated to a pressure of no greater than about 50 psi during heating, which is typically carried out in a steam autoclave, hot air kiln or an infrared oven. Temperature ranges between 150°F and 260°F are discussed, with temperatures up to 280°F mentioned. Within the desired temperature range, temperatures of about 230°-260°F are preferred. Temperatures of 275° are mentioned as not being uncommon for rayon.

Devitt et al lacks a showing of providing a 360-degree circumferential tread restraint during the inflation and heating. According to the text quoted above, in all cases, the tire is heated to perform the procedure.

The overall object of the present invention is to provide both method and apparatus for post-cure correction (PCC), either partial or substantial, of various tire nonuniformities which have been detected during a tire manufacturing process by a tire uniformity machine (TUM), preferably testing a tire which has been nominally cooled down (i.e., nominally completed curing) after removal from a tire curing mold.

Rhyne (5,365,781) (see 280 in Fig. 8 and col. 13, lines 32-36), discloses tire uniformity correction without grinding. A tire 40 is mounted on a simulated rim 142, 162. Restraint rings 182 (FIG. 8) engage the sidewalls with different axial displacements D1,D2 to impart a different radius of curvature R1,R2 to the portion of the carcass reinforcing member 306 (FIG. 9) in each of the sidewalls. The restraint rings 182 are used preferably only when inflation pressure is used for correction. A belt restraint ring 280 (FIG. 8) may be optionally provided to counteract the relatively high inflation pressures so that the belt package 46 is not excessively expanded in the

circumferential direction.

Rhyne's belt restraint ring is simply a cylinder (ring) having a flat inner surface, and a diameter selected based on the diameter of the tire.

In claim 1 of the present invention, there is provided ...

providing a 360 degree circumferential tread restraint which holds the tread in an ideal tread shape, concentric to the axis of rotation and nominally perpendicular to the equatorial plane; for a controlled time while the tread is restrained and the beads are sealingly held.

Rhyne neglects to ensure that the belt restraint ring remains centered (concentric to the axis of rotation)and perpendicular to the equatorial plane - it is just used to restrain the tire from expanding during the corection procedure.

Rhyne does hold the beads, presumably (as claimed herein) sealingly holding the beads concentric to, and equidistant from, the axis of rotation and symmetrically spaced about the equatorial plane; Applicant would admit, that as long as the tire beads are not intentionally deformed, and they are mounted on some kind of normal rim or simulated rim, the bead circles define the axis of rotation.

But that's just the half of it. In order to practice the present invention you really need to ensure that the tread remains concentric to the axis of rotation and perpendicular to the equatorial plane, and Rhyne utterly fails in this regard. Applicant would go so far to suggest that Rhyne might not work if his belt restraint were "fixed". When the restrain rings 182 come in to play, it seems quite possible that the circle of the belt (hence, the belt restraint 280) will shift radially, and not be concentric to the axis of rotation.

Further, as noted in the application, Referring to Figures 1 to 1C (1,1A,1B,1C), in order to simulate a road surface simultaneously pressing against the tire tread 122 at all points of the 360 degree tread circumference, the tread contacting surface 111 of the tread restraint (e.g., segmented tread plates 103 of the restraint segments 100) has an "ideal shape" which closely

matches the ideal contour of the tread 122 of an inflated tire 120. The idea is to make the tread contacting surface 111 as flat as possible (like a road surface) but still touching the entire ground contacting (footprint) portion of the inflated tires tread 122. The tread plate 103 surface 111 must match the typically curved contour of the inflated tire's tread 122, because in order to completely flatten the entire footprint area of the tread 122 simultaneously around the entire circumference, the tire belt package 129 would have to buckle circumferentially (such as when one squeezes a soda can). A further characteristic of the ideal shape for the tread 122 is that the tread 122 from shoulder 123 to shoulder 124 should be aligned properly with the beads 127, 128 around the entire circumference of the tire 120, i.e., the beads 127, 128 should be symmetrically spaced about the equatorial plane of the tread 122. Finally, the ideal tread shape has the characteristic of nominal perpendicularity to the equatorial plane, such that even if the tread 122 surface is slightly curved as explained hereinabove, the tread surface will be symmetric about the equatorial plane, with the tangent to the tread surface being substantially perpendicular to the equatorial plane where the equatorial plane intersects the tread surface(at the equator), and also the tread shoulders 123, 124 are radially equidistant from the tire axis of rotation (as are the beads 127, 128 which can be used to determine the tire's axis of rotation).

It is evident from all the relevant illustrations that the "ideal tread shape" is slightly curved, not flat as in Rhyne. Rhyne makes no effort to address "tread shape".

Wolfer (3,120,571; see 10 in the Figures) discloses method of tire diameter regulation in post inflation. He also has a ring 10. The surface 14 of the ring 10 is concave to match or approximate the molded tread radius of the tire. But, does Wolfer have an "ideal tread shape"?

In order to clarify the special meaning of the term "ideal tread shape", in **claims 1 and 17**, the phrase "wherein the ideal tread shape closely matches the ideal contour of the tread of an inflated tire" is added at the end of the clause that originally ended with the words "equatorial plane". This definition of the term can be found on page 15, lines 14-15 of the detailed description.

To make the special meaning clear, Applicant has inserted a summary definition of the term into

the amended independent **claim 1 (and 17)**, as discussed hereinabove, to wit: "wherein the ideal tread shape closely matches the ideal contour of the tread *the tire when inflated*" (italics added). This is an important distinction because restraint to that particular contour is necessary in order to meet a stated objective of improving the footprint shape factor.

Further limitation of the tread restraint is stated in newly-presented **claim 20** that cites the following method step: "shaping the tread restraint such that it touches all of a footprint portion of the tread for orienting the tire and the ply cords to optimize a footprint shape factor". It can be seen that all of the clauses in the amended independent claim work together to form a novel method of constrained PCI (post cure inflation), i.e., a method that has the features needed to achieve footprint shape factor optimization as described in the test results detailed on page 26, lines 7-10. The summary statement on page 26, lines 11-17 notes that test results (see page 25) confirmed that the inventive method is *also* effective in improving tire uniformity "simultaneously" with footprint tuning. When compared with Wolfer and other known prior art, it becomes clear that the present invention lies in the method steps that are uniquely suited toward achieving footprint optimization in addition to the well known uniformity improvement benefits of prior art PCI, whether constrained or not.

- In addition to the claimed special restraint shape, another distinguishing feature of the claimed invention is that the tread restraint "holds the tread in an ideal tread shape, *concentric to the axis of rotation*" (italics added). Wolfer does not teach about the importance of this feature. Although the apparatuses shown in Wolfer's Fig. 7 and 8 would logically provide concentricity, Wolfer teaches that the apparatus of Fig. 1-5 is equally effective for implementing the method of his invention, and for meeting the objectives of his invention, i.e., "making vehicle tires having uniform diameters and tread surfaces" and "for controlling the radial growth of the tire during the post-inflation cycle" (column 2, lines 22-29). Furthermore, the invention as claimed contains no mention of concentricity or of controlling the concentricity of the circumferential confinement means. Instead, the claims restate the objectives/benefits/purpose as, for example, "a uniform diameter whereby irregularity, out-of-roundness, and internal stress...due to tire growth during said cooling are minimized" (claim 2). Wolfer's free-floating restraint ring (e.g., Fig. 5) will

achieve a uniform diameter, round tire but would still allow the round tire tread to be non-concentric to the tire bead. By teaching that a free floating ring is effective for implementing his invention, Wolfer makes it clear that concentricity is *not* an obvious part of his invention. Similarly, the other prior art references do not contain any teaching about concentricity being required in a constrained PCI device and method.

German Offenleg 1,729,614 (see Abstract). It is not clear to applicant why this reference is cited. No drawings.

Based on the above, the rejection is traversed.

Additionally, it should be noted that, in dependent claim 6, a location on the selected tire for heating during the heating step is determined by a location and type of one or more of the at least one tire uniformity defects. The cited references do not suggest such selective heating.

Regarding the double patenting rejection

US 6660212 has only method claims. This application has method and apparatus claims.

-As the Examiner notes US 6,660,212 recites that such correction occurs during a post cure inflation while the instant claims are directed to such a correction after the post cure inflation when the defect has been determined.

This is correct, and is a distinction with a difference.

As noted in the Application (page 2, lines 1-8):

In the mold, the tire's green rubber initially softens under heat but eventually cures (stiffens through polymerization) enough to be removed from the mold and allowed to cool outside the mold, where the curing reaction continues until the tire is cool. In some cases, the tire is inflated on a post-cure inflation stand ("PCI stand") while cooling, to keep the tire shape uniform and the ply uniformly stretched, to prevent the ply from shrinking nonuniformly when

the tire is still hot from the mold.

Uniformity Characteristics

After a tire is cured, it is typically tested for uniformity characteristics ....

As noted in the Application (page 3, lines 8-11):

Tum Apparatus

After a tire is cured and cooled, it is tested on a force variation machine (also called "tire uniformity machine", abbreviated "TUM", "tire uniformity inspecting machine", and "tire uniformity apparatus").

As noted in the Application (page 5, lines 10-18):

Post-Cure Inflation

Various patented methods (e.g., U.S. Patents 4,420,453 and 2,963,737) of improving uniformity of a cured tire are based on "post-cure inflation" ("PCI" or "post-inflation"), defined as mounting a hot cured tire (soon after removal from the curing mold, before it has cooled down from the curing process in the mold) on a rim and keeping it inflated as it cools. The patented methods differ as to the inflation pressure, whether to spray-cool, and when to start and end the post-inflation. Although these processes are referred to as "post-cure" processing, in reality a tire generally continues to cure as it cools down after removal from the curing mold.

<u>Claim 1 of 6,660,212</u>

1. Method of constrained post cure inflation for a radial ply tire having beads, ply cords, and a tread; the method comprising the steps of:

initiating the method of constrained post cure inflation on the radial ply tire after the radial ply tire has been removed from a tire curing mold;

providing a constrained post cure inflation device having a 360 degree circumferential tread restraint device having a 360 degree tread restraint surface disposed at an equal radial distance from a central axis through the constrained post cure inflation device, the tread restraint surface being formed from a plurality of segmented tread restraint plates adapted to hold the tread

of the tire in a predefined ideal tread shape, concentric to an axis of rotation and nominally perpendicular to an equatorial plane of the tire;

opening the plurality of segmented tread restraint plates radially outward from the central axis;

inserting the radial ply tire into the constrained post cure inflation device so that the beads are sealingly held concentric to, and equidistant from, the axis of rotation, and symmetrically spaced about the equatorial plane;

closing the plurality of segmented tread restraint plates radially inward toward the central axis;

inflating the tire to a controlled pressure to simultaneously press the tread of the tire against the 360 degree tread restraint surface; and

holding the controlled pressure for a controlled time while at least a portion of the ply cords are at a controlled temperature above a glass transition temperature of the ply cord material so that the ply cord stresses are normalized.

<u>Claim 1 of the Present Invention</u>

1. (presently amended) Method of post cure correction of tire uniformity for a tire having beads, an axis of rotation, and a tread having an equatorial plane; the method comprising the steps of:

selecting the tire during a tire manufacturing process after the selected tire has been rejected by a tire uniformity test due to at least one tire uniformity defect;

providing <u>a</u> 360 degree circumferential tread restraint which holds the tread <u>of the tire</u> in an ideal tread shape, concentric to the axis of rotation and nominally perpendicular to the equatorial plane<u>, wherein the ideal tread shape closely matches the ideal contour of the tread of the tire when inflated</u>;

sealingly holding the beads concentric to, and equidistant from, the axis of rotation, and symmetrically spaced about the equatorial plane; and

inflating the selected tire to a controlled pressure, and holding the controlled pressure for a controlled time while the tread is restrained and the beads are sealingly held.

<u>Claim 17 of the present invention</u>

17. (presently amended) An apparatus for post cure correction of tire uniformity for a tire having beads, an axis of rotation, and a tread having an equatorial plane; wherein the apparatus comprises:

means for providing 360 degree circumferential tread restraint which holds the tread in an ideal tread shape, concentric to the axis of rotation and nominally perpendicular to the equatorial plane<u>, wherein the ideal tread shape closely matches the ideal contour of the tread of the tire when inflated</u>;

means for sealingly holding the beads concentric to, and equidistant from, the axis of rotation, and symmetrically spaced about the equatorial plane; and

means for inflating the selected tire to a controlled pressure, and holding the controlled pressure for a controlled time while the tread is restrained and the beads are sealingly held.

Conclusion

Favorable examination and consideration are respectfully requested. Early allowance of the application is respectfully requested.

Respectfully submitted,

Howard M. Cohn

Howard M. Cohn
Registration No. 25,808

Howard M. Cohn
c/o Bruce Hendricks Dept. 823
The Goodyear Tire & Rubber Company
1144 East Market Street
Akron, Ohio 44316-0001
(216) 752-0955 phone
(216)752-0957 fax

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